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Yang

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(54) **AREA NETWORK SYSTEM AND NETWORK CONNECTION METHOD**

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(51) **Int. Cl.**

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H04L 12/701	(2013.01)
H04L 12/715	(2013.01)
H04L 12/741	(2013.01)
H04L 29/12	(2006.01)

(52) **U.S. Cl.**

CPC ***H04L 12/2803*** (2013.01); ***H04L 45/00*** (2013.01); ***H04L 45/64*** (2013.01); ***H04L 45/745*** (2013.01); *H04L 61/20* (2013.01); *H04L 61/2007* (2013.01); *H04L 61/2038* (2013.01)

(58) **Field of Classification Search**

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USPC 370/310, 328

See application file for complete search history.

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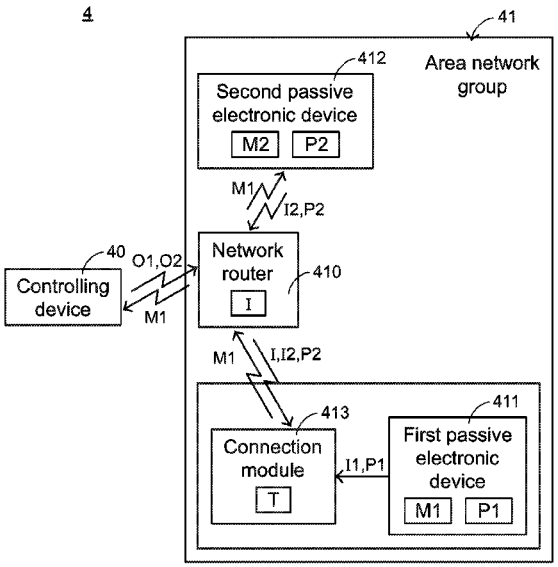
(57) **ABSTRACT**

A network connection method is provided. Firstly, plural communication address data and plural connecting port data are automatically transmitted from plural devices of an area network group to a connection module according to the UPnP protocol and the DLNA protocol. A communication address look-up table is created by the connection module of the passive electronic device according to the communication address data and the plural connecting port data. In addition, the communication address look-up table is transmitted to a network router of the area network group. Consequently, a controlling device can be connected to a passive electronic device of the area network group. Consequently, it is not necessary to input the communication address data and the connecting port data through manual settings.

12 Claims, 6 Drawing Sheets



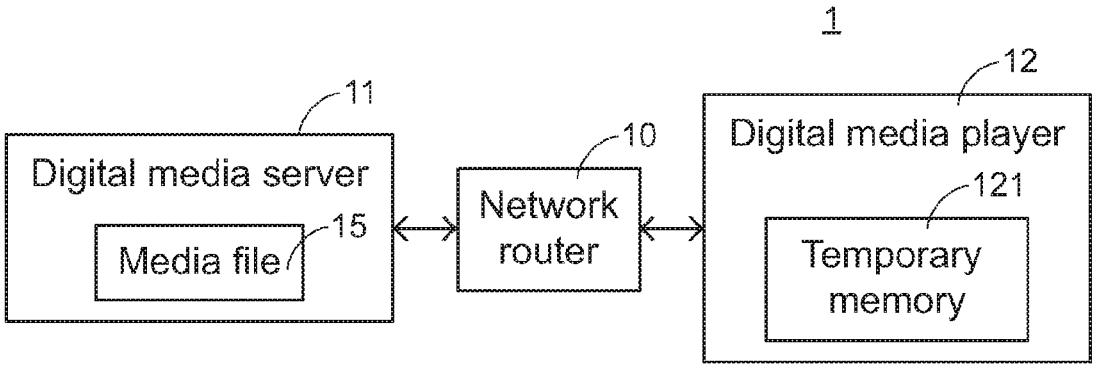


FIG.1
PRIOR ART

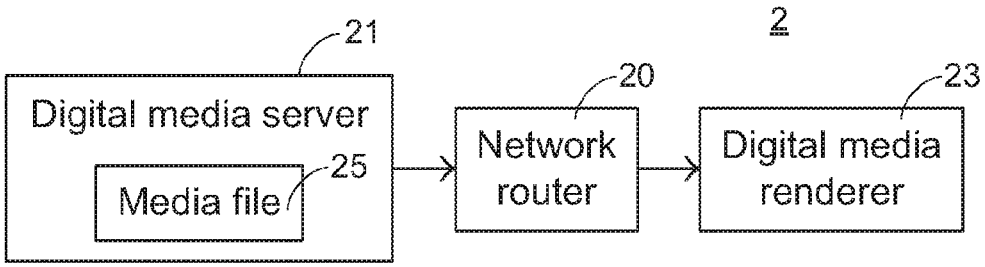


FIG.2
PRIOR ART

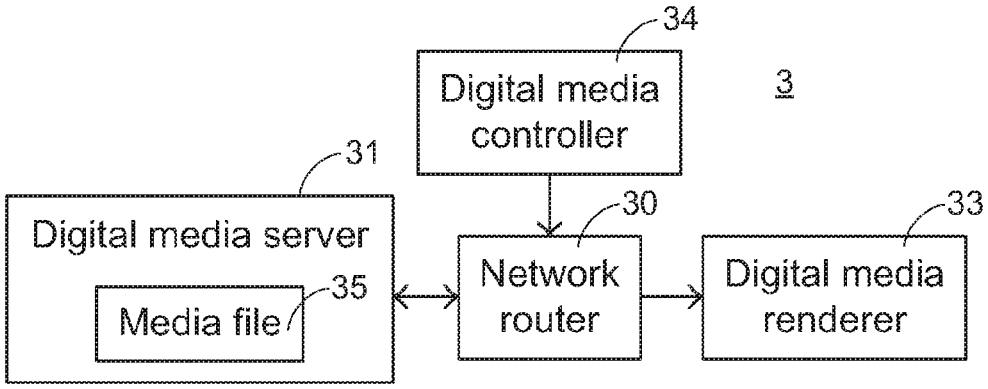


FIG.3
PRIOR ART

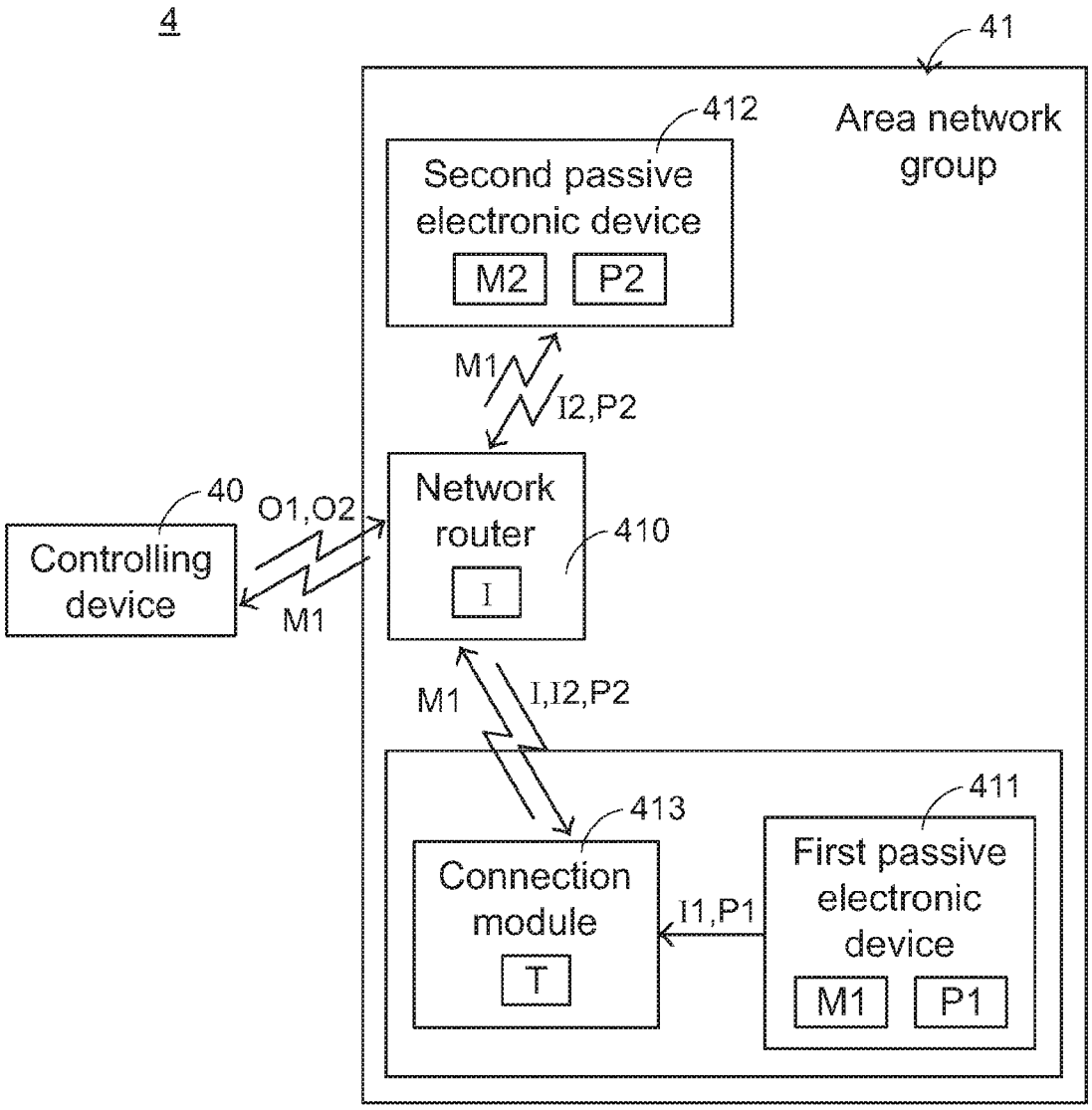

4
41
Area network group
412
Second passive electronic device
M2
P2
M1
I2,P2
Network router
I
410
40
O1,O2
Controlling device
M1
M1
I,I2,P2
413
Connection module
T
I1,P1
411
First passive electronic device
M1
P1

FIG.4

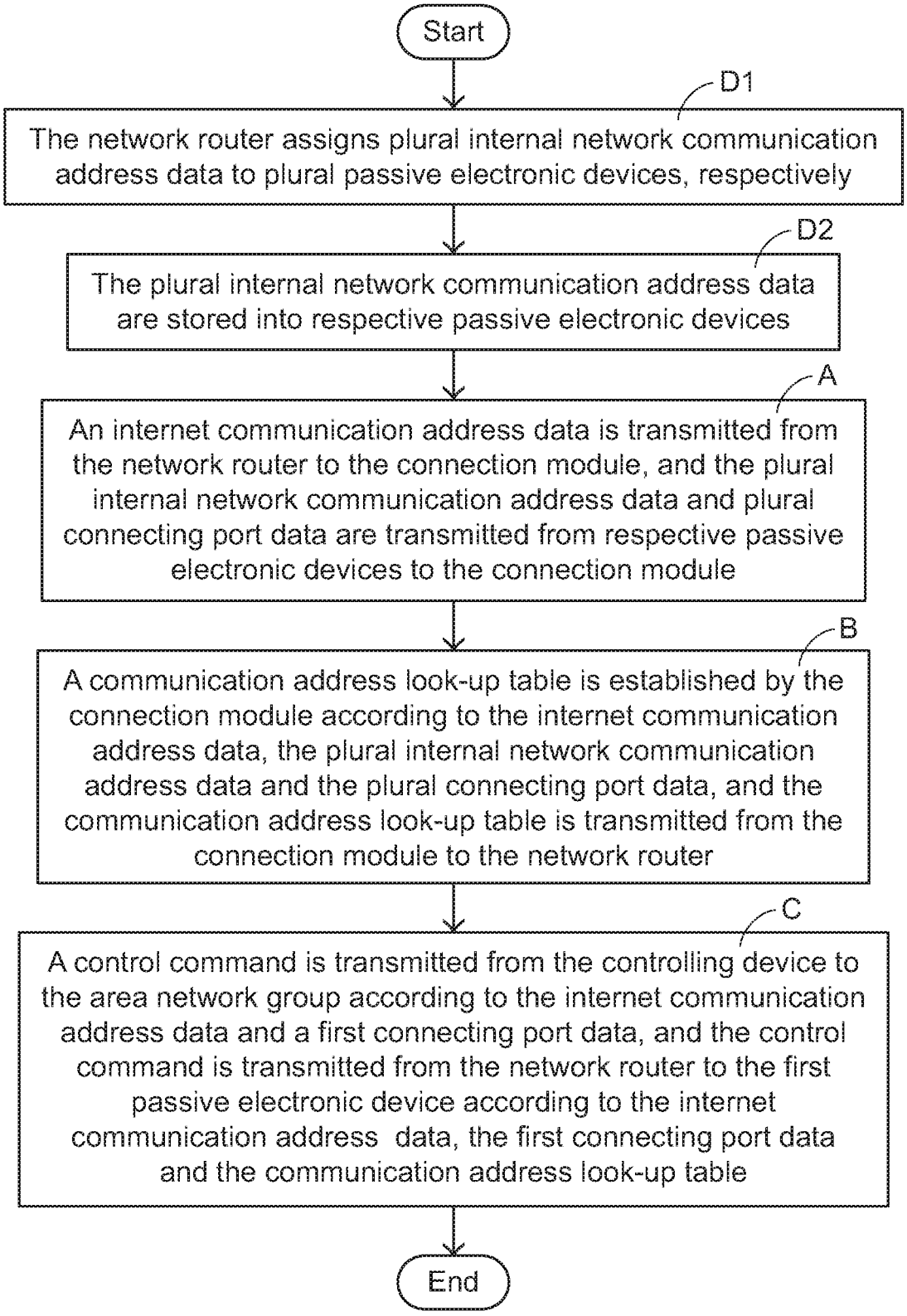

Start
D1
The network router assigns plural internal network communication address data to plural passive electronic devices, respectively
D2
The plural internal network communication address data are stored into respective passive electronic devices
A
An internet communication address data is transmitted from the network router to the connection module, and the plural internal network communication address data and plural connecting port data are transmitted from respective passive electronic devices to the connection module
B
A communication address look-up table is established by the connection module according to the internet communication address data, the plural internal network communication address data and the plural connecting port data, and the communication address look-up table is transmitted from the connection module to the network router
C
A control command is transmitted from the controlling device to the area network group according to the internet communication address data and a first connecting port data, and the control command is transmitted from the network router to the first passive electronic device according to the internet communication address data, the first connecting port data and the communication address look-up table
End

FIG.5

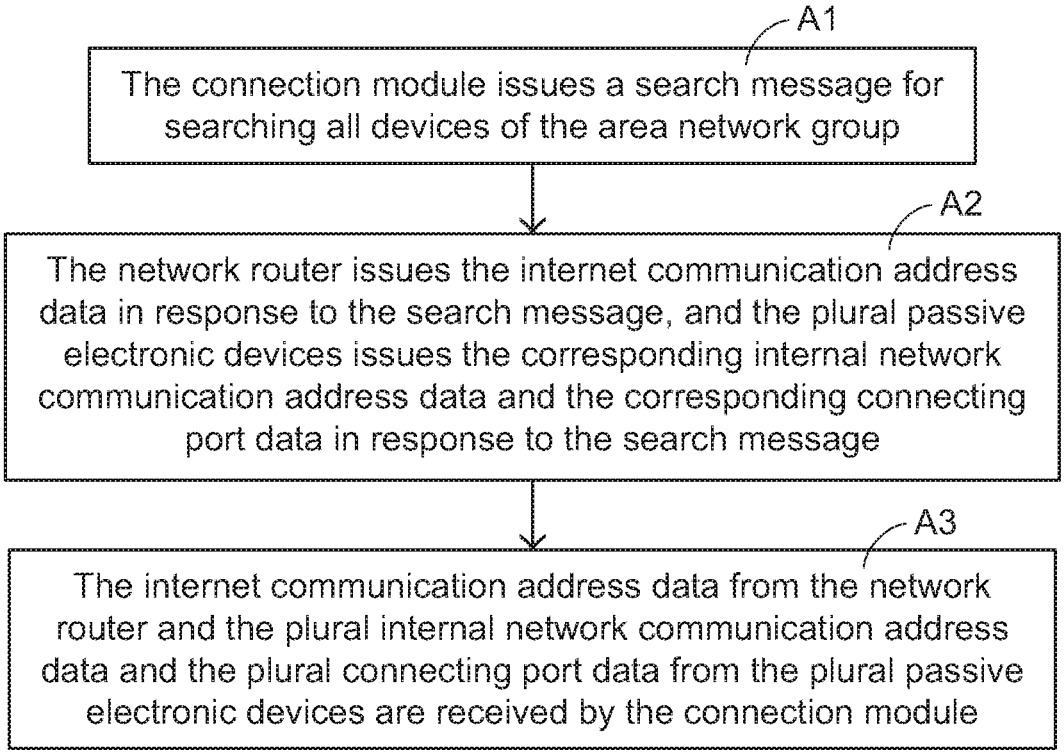

A1
The connection module issues a search message for searching all devices of the area network group
A2
The network router issues the internet communication address data in response to the search message, and the plural passive electronic devices issues the corresponding internal network communication address data and the corresponding connecting port data in response to the search message
A3
The internet communication address data from the network router and the plural internal network communication address data and the plural connecting port data from the plural passive electronic devices are received by the connection module

FIG.6

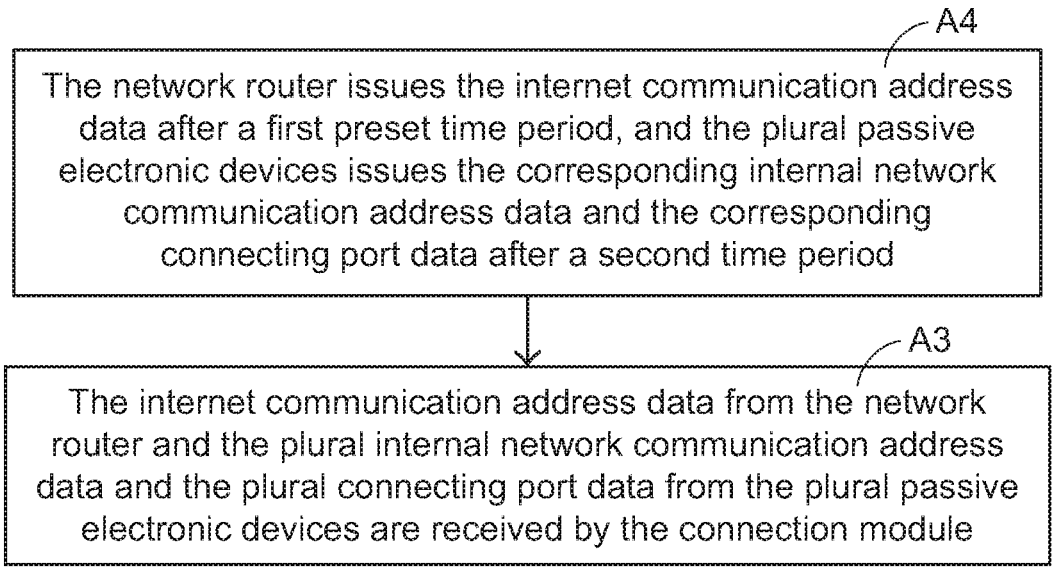

A4
The network router issues the internet communication address data after a first preset time period, and the plural passive electronic devices issues the corresponding internal network communication address data and the corresponding connecting port data after a second time period
A3
The internet communication address data from the network router and the plural internal network communication address data and the plural connecting port data from the plural passive electronic devices are received by the connection module

FIG.7

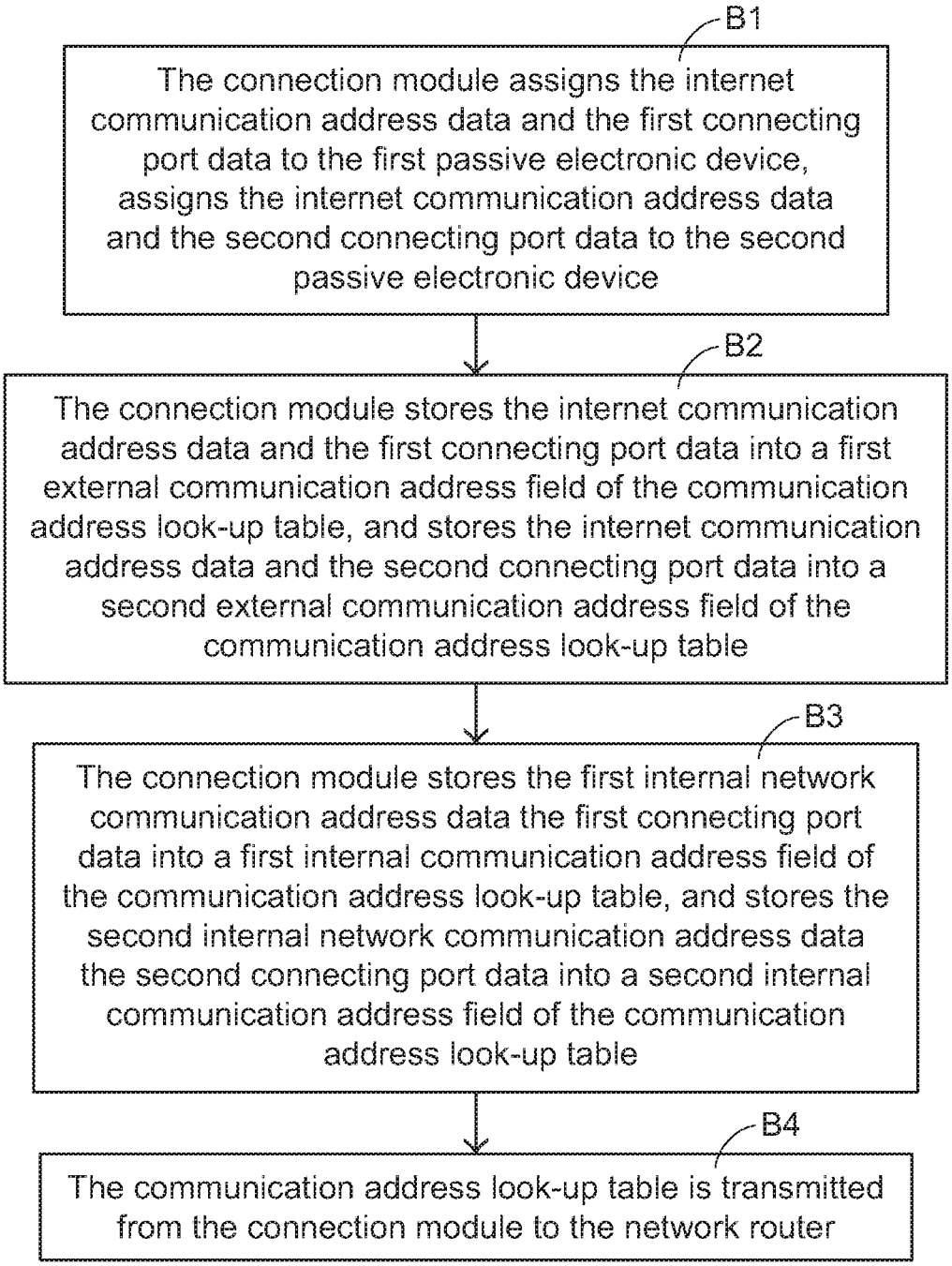

B1
The connection module assigns the internet communication address data and the first connecting port data to the first passive electronic device, assigns the internet communication address data and the second connecting port data to the second passive electronic device
B2
The connection module stores the internet communication address data and the first connecting port data into a first external communication address field of the communication address look-up table, and stores the internet communication address data and the second connecting port data into a second external communication address field of the communication address look-up table
B3
The connection module stores the first internal network communication address data the first connecting port data into a first internal communication address field of the communication address look-up table, and stores the second internal network communication address data the second connecting port data into a second internal communication address field of the communication address look-up table
B4
The communication address look-up table is transmitted from the connection module to the network router

FIG.8

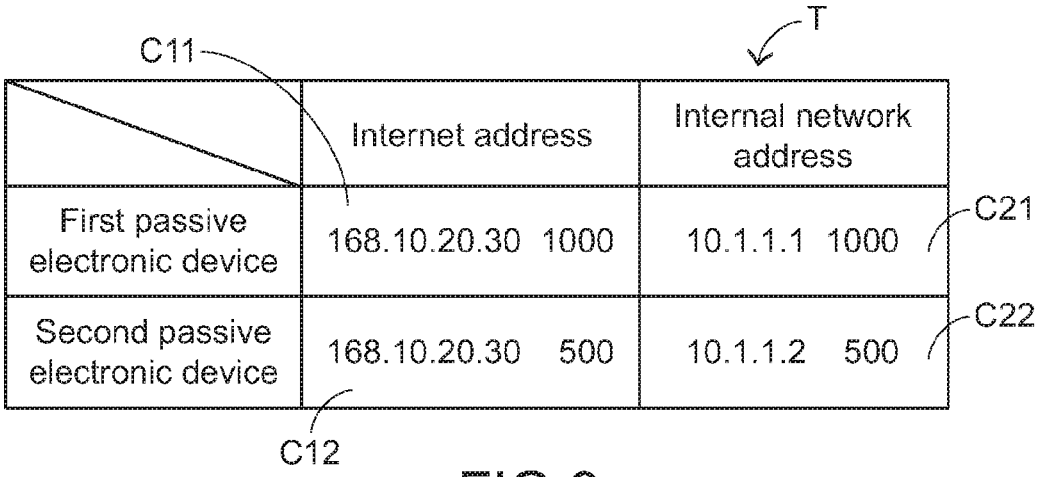

T
C11
Internet address
Internal network address
First passive electronic device
168.10.20.30 1000
10.1.1.1 1000
C21
Second passive electronic device
168.10.20.30 500
10.1.1.2 500
C22
C12

FIG.9

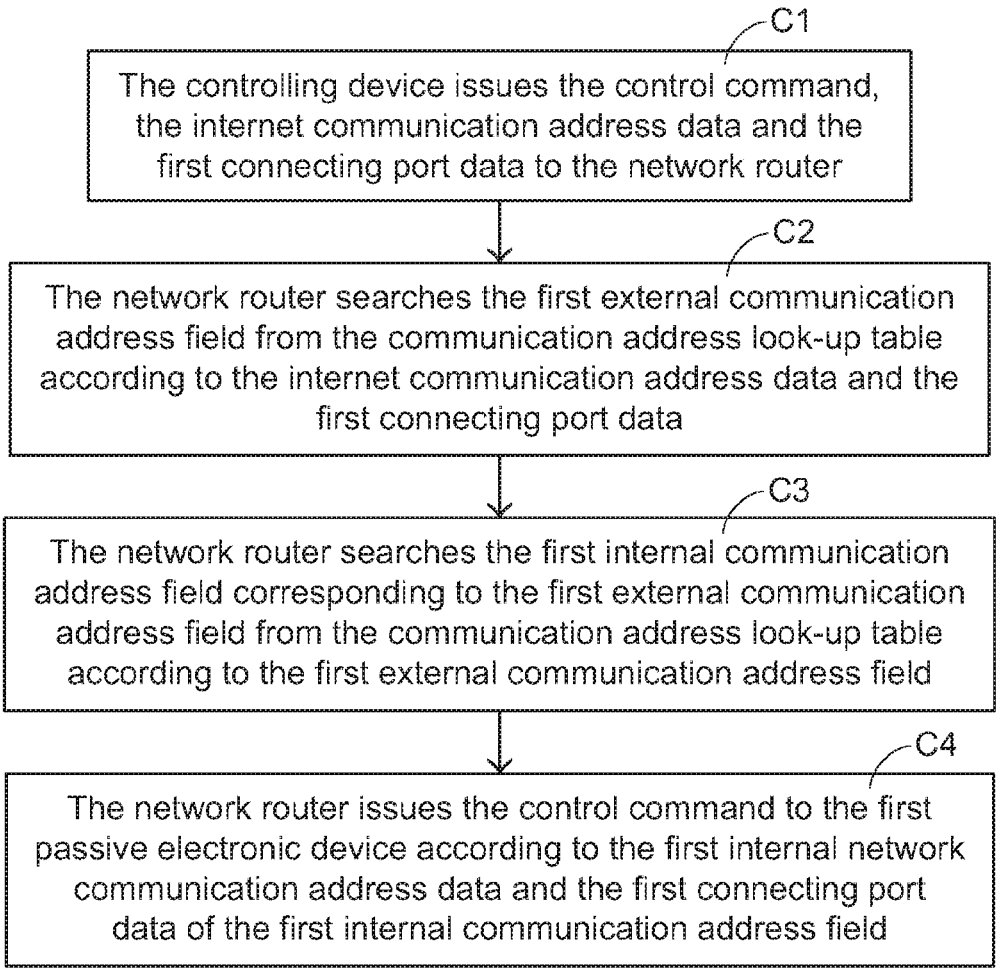

C1
The controlling device issues the control command, the internet communication address data and the first connecting port data to the network router
C2
The network router searches the first external communication address field from the communication address look-up table according to the internet communication address data and the first connecting port data
C3
The network router searches the first internal communication address field corresponding to the first external communication address field from the communication address look-up table according to the first external communication address field
C4
The network router issues the control command to the first passive electronic device according to the first internal network communication address data and the first connecting port data of the first internal communication address field

FIG.10

AREA NETWORK SYSTEM AND NETWORK CONNECTION METHOD

FIELD OF THE INVENTION

The present invention relates to a network connection method for connecting with an area network group, and more particularly to a network connection method for connecting with an electronic device of an area network group.

BACKGROUND OF THE INVENTION

Generally, an area network group comprises a local area network (LAN), a metropolitan area network (MAN) and a wide area network (WAN). With increasing development of science and technology, the area network group further comprises a universal plug and play (UPnP) group and a Digital Living Network Alliance (DLNA). For example, the Digital Living Network Alliance (DLNA) is an alliance organization that is composed by the manufacturers of consumer electronics products, mobile phones and computers. The DLNA is responsible for defining unified transmission specifications to allow a variety of products from different manufacturers to be connected and communicated with each other. Consequently, a first electronic device and a second electronic device that comply with the DLNA protocol can be in direct communication with each other in order to transfer data or make synchronization actions.

First of all, some DLNA architectures will be illustrated as followed. FIG. **1** schematically illustrates a first conventional DLNA architecture. As shown in FIG. **1**, the first conventional DLNA architecture **1** comprises a network router **10**, a digital media server (DMS) **11**, and a digital media player (DMP) **12**. The network router **10** is connected to an internet (not shown). In addition, the network router **10** is in communication with the digital media server **11** and the digital media player **12**. Consequently, the communication between the digital media server **11** and the digital media player **12** is established through the network router **10**. A media file **15** is stored in the digital media server **11**. The media file **15** is for example an audio file, an image file or a video file. After the digital media player **12** is in communication with the digital media server **11**, the digital media player **12** may search the media file **15** from the digital media server **11**. After the media file **15** is selected by the user through the digital media player **12**, the media file **15** is transmitted from the digital media server **11** to a temporary memory **121** of the digital media player **12**. After the media file **15** is received by the digital media player **12**, the media file **15** that is temporarily stored in the temporary memory **121** can be played by the digital media player **12**.

FIG. **2** schematically illustrates a second conventional DLNA architecture. As shown in FIG. **2**, the second conventional DLNA architecture **2** comprises a network router **20**, a digital media server (DMS) **21**, and a digital media renderer (DMR) **23**. The communication between the digital media server **21** and the digital media renderer **23** is established through the network router **20**. The digital media server **21** is used for storing a media file **25**. In addition, the digital media server **21** further provides a control function of controlling operations of the digital media renderer **23**. The digital media renderer **23** is used for receiving and playing the media file **25** that is transmitted from the digital media server **21**. After the control function of the digital media server **21** is utilized to select the stored media file **25** from the digital media server **21**, the media file **25** is transmitted from the digital media server **21** to the digital media renderer **23**. Consequently, the media file **25** can be played by the digital media renderer **23**.

FIG. **3** schematically illustrates a third conventional DLNA architecture. As shown in FIG. **3**, the third conventional DLNA architecture **2** comprises a network router **30**, a digital media server (DMS) **31**, a digital media renderer (DMR) **33**, and a digital media controller (DMC) **34**. The communication between the digital media server **31**, the digital media renderer **33** and the digital media controller **34** is established through the network router **30**. The digital media server **31** is used for storing a media file **35**. The digital media renderer **33** is used for receiving and playing the media file **35** that is transmitted from the digital media server **31**. The digital media controller **34** provides a control function. After the control function of the digital media controller **34** is utilized to select the stored media file **35** from the digital media server **31**, the media file **35** is transmitted from the digital media server **31** to the digital media renderer **33**. Consequently, the media file **35** can be played by the digital media renderer **33**.

As mentioned above, the digital media server, the digital media controller, the digital media renderer and the digital media player that are included in the same network domain and comply with the DLNA protocol may transfer or play media files through the network router. The digital media server and the digital media renderer may be referred as passive electronic devices that can be controlled. Moreover, the digital media controller and the digital media player may be referred as active electronic devices that can control the passive electronic devices. For example, a user in a living room may allow a mobile phone to be connected to a computer host in a study room. Moreover, through the mobile phone, the user may browse the audio files in the computer and select a desired audio file from the computer. Then, the selected audio file is transmitted from the mobile phone to a stereo device in the living room. After the audio file is received by the stereo set, the audio file is played by the stereo device. Consequently, the purposes of conveniently and quickly sharing media contents can be achieved.

The above method of sharing media contents is not only applied to the same area network group. When the user intends to connect an external active electronic device to the network area, the user has to previously input the internal network communication address data and the connecting port data of the passive electronic device into the network router of the area network group through manual settings. After the manual settings are completed, the user may issue a control command to the network router of the area network group according to the internet communication address data of the network router and the connecting port data of the passive electronic device to be controlled. Moreover, the network router issues the control command to the passive electronic device according to the connecting port data of the passive electronic device. Consequently, the passive electronic device executes a corresponding controlled task according to the control command.

However, the method of manually inputting associated data into the network router through manual settings may result in two drawbacks. Firstly, it is difficult for most users to realize the internet communication address data, the internal network communication address data and the connecting port data. Consequently, the method of manually inputting associated data through manual settings is very complicated to most users. Generally, the setting procedure has to be performed by the professional engineers. Secondly, if a passive electronic device is newly added to the area network group or a passive electronic device in the area network group is turned off, the user has to manually add or delete the internal network communication address data and the connecting port data of

the passive electronic device again. The way of repeatedly performing the manual setting procedure is not user-friendly.

Therefore, there is a need of providing an area network system and a network connection method without manual settings.

SUMMARY OF THE INVENTION

The present invention provides an area network system and a network connection method without manual settings.

In accordance with an aspect of the present invention, there is provided a network connection method for connecting a controlling device to at least one passive electronic device of an area network group. The network connection method includes the following steps. In a step (A), a connection module of the area network group receives an internet communication address data from a network router of the area network group and at least one internal network communication address data and at least one connecting port data from the at least one passive electronic device. In a step (B), the connection module creates a communication address look-up table according to the internet communication address data, the at least one internal network communication address data and the at least one connecting port data, and transmits the communication address look-up table to the network router. In a step (C), a control command is transmitted from the controlling device to the area network group according to the internet communication address data and the at least one connecting port data, and the control command is transmitted from the network router to the at least one passive electronic device according to the internet communication address data, the at least one connecting port data and the communication address look-up table.

In accordance with another aspect of the present invention, there is provided an area network system. The area network system includes a controlling device and an area network group. The controlling device issues a control command according to an internet communication address data and at least one connecting port data. The area network group is connected to the controlling device through network connection. The area network group includes a network router, at least one passive electronic device, and a connection module. The network router is connected to the controlling device through network connection to provide a network connection function and receive the control command, wherein the internet communication address data is previously stored in the network router. The at least one passive electronic device is connected to the network router through network connection. An internal network communication address data and a corresponding connecting port data of the at least one connecting port data are previously stored in each of the at least one passive electronic device. The connection module is connected to the network router through network connection for creating a communication address look-up table according to the internet communication address data, the at least one internal network communication address data and the at least one connecting port data, and transmitting the communication address look-up table to the network router. When the control command is received by the network router, the control command is transmitted from the network router to the at least one passive electronic device according to the internet communication address data, the at least one connecting port data and the communication address look-up table.

The above objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** schematically illustrates a first conventional DLNA architecture;

FIG. **2** schematically illustrates a second conventional DLNA architecture;

FIG. **3** schematically illustrates a third conventional DLNA architecture;

FIG. **4** is a schematic functional block diagram illustrating an area network system according to an embodiment of the present invention;

FIG. **5** is a flowchart illustrating a network connection method according to an embodiment of the present invention;

FIG. **6** is a flowchart illustrating the step (A) of the network connection method according to an embodiment of the present invention;

FIG. **7** is a flowchart illustrating the step (A) of the network connection method according to another embodiment of the present invention;

FIG. **8** is a flowchart illustrating the step (B) of the network connection method according to an embodiment of the present invention;

FIG. **9** schematically illustrates a communication address look-up table of the area network system according to an embodiment of the present invention; and

FIG. **10** is a flowchart illustrating the step (C) of the network connection method according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

For eliminating the drawbacks of the conventional technology, the present invention provides a network connection method for connecting with an area network group and an area network system using the network connection method of the present invention.

Hereinafter, an area network system of the present invention will be illustrated. FIG. **4** is a schematic functional block diagram illustrating an area network system according to an embodiment of the present invention. As shown in FIG. **4**, the area network system **4** comprises a controlling device **40** and an area network group **41**. The area network group **41** is connected to the controlling device **40** through network connection. The area network group **41** comprises a network router **410**, a first passive electronic device **411**, a second passive electronic device **412**, and a connection module **413**. The network router **410** is used to provide a network connection function. Through the network router **410**, the first passive electronic device **411** and the second passive electronic device **412** are connected with each other through network connection. In this embodiment, the connection module **413** is a software component and included in the first passive electronic device **411**. Moreover, the network router **410** complies with the universal plug and play (UPnP) protocol. Moreover, both of the first passive electronic device **411** and the second passive electronic device **412** comply with the Digital Living Network Alliance (DLNA) protocol. In an embodiment, the first passive electronic device **411** is a digital media server, and the second passive electronic device **412** is a digital media renderer such as a stereo device or a display screen.

Hereinafter, a network connection method for connecting with an area network group according to the present invention

will be illustrated with reference to FIG. **5**. FIG. **5** is a flowchart illustrating a network connection method according to an embodiment of the present invention.

Firstly, in the step (D1), the network router assigns plural internal network communication address data to plural passive electronic devices, respectively. In the step (D2), the plural internal network communication address data are stored into respective passive electronic devices. In the step (A), an internet communication address data is transmitted from the network router to the connection module, and the plural internal network communication address data and plural connecting port data are transmitted from respective passive electronic devices to the connection module. In the step (B), a communication address look-up table is created by the connection module according to the internet communication address data, the plural internal network communication address data and the plural connecting port data, and the communication address look-up table is transmitted from the connection module to the network router. In the step (C), a control command is transmitted from the controlling device to the area network group according to the internet communication address data and a first connecting port data, and the control command is transmitted from the network router to the first passive electronic device according to the internet communication address data, the first connecting port data and the communication address look-up table.

Hereinafter, the detailed procedures of the steps (D1)~(D2) performed by the area network system **4** of the present invention will be illustrated with reference to FIGS. **4** and **5**. A first connecting port data P**1** is previously stored in the first passive electronic device **411**. For example, the first connecting port data P**1** is 1000. A second connecting port data P**2** is previously stored in the second passive electronic device **412**. For example, the second connecting port data P**2** is 500. Then, the step (D1) is performed by the network router **410**. For example, the network router **410** assigns a first internal network communication address data I**1** to the first passive electronic device **411** and assigns a second internal network communication address data I**2** to the second passive electronic device **412**. Then, the step (D2) is performed by the first passive electronic device **411** and the second passive electronic device **412**. That is, the first internal network communication address data I**1** is stored into the first passive electronic device **411**, and the second internal network communication address data I**2** is stored into the second passive electronic device **412**. Moreover, an internet communication address data I is previously stored in the network router **410**. In this embodiment, the internet communication address data I is an internet protocol address (IP address), and the first internal network communication address data I**1** and the second internal network communication address data I**2** are communication addresses of the internal network. For example, the internet communication address data I is 168.10.20.30, the first internal network communication address data I**1** is 10.1.1.1, and the second internal network communication address data I**2** is 10.1.1.2.

In this embodiment, the internet communication address data I is assigned to the network router **410** by an internet service provider, and the first internal network communication address data I**1** and the second internal network communication address data I**2** are respectively assigned to the first passive electronic device **411** and the second passive electronic device **412** by the network router **410**. Furthermore, the internet communication address data I is used for allowing the connecting device **40** to be connected to the area network group **41** through network connection. That is, the connecting device **40** may be connected to the network router **410** through network connection according to the internet communication address data I (e.g. 168.10.20.30). The first internal network communication address data I**1** and the second internal network communication address data I**2** are used for establishing internal connection in the area network group **41**. That is, any device in the area network group **41** may be connected to the first passive electronic device **411** through network connection according to the first internal network communication address data I**1** (e.g. 10.1.1.1) and the first connecting port data P**1**, and any device in the area network group **41** may be connected to the second passive electronic device **412** through network connection according to the second internal network communication address data I**2** (e.g. 10.1.1.2) and the second connecting port data P**2**.

After the step (D2), the step (A) is performed by the area network system **4**. Hereinafter, the detailed procedure of the step (A) performed by the area network system **4** will be illustrated with reference to FIGS. **4** and **6**. FIG. **6** is a flowchart illustrating the step (A) of the network connection method according to an embodiment of the present invention. The step (A) comprises the following sub-steps. In the sub-step (A1), the connection module issues a search message for searching all devices of the area network group. In the sub-step (A2), the network router issues the internet communication address data according to the search message, and the plural passive electronic devices issues the corresponding internal network communication address data and the corresponding connecting port data according to the search message. In the sub-step (A3), the internet communication address data from the network router and the plural internal network communication address data and the plural connecting port data from the plural passive electronic devices are received by the connection module.

In particular, the sub-steps (A1)~(A3) are the procedures of transmitting data to the connection module **413** by the area network system **4**. When the area network system **4** intends to establish the internal connection of the area network group **41**, the connection module **413** issues a search message (not shown) in a broadcasting form so as to search all devices of the area network group **41** (i.e. the step (A1) is performed by the connection module **413**). After the search message is received by the network router **410**, the internet communication address data I is transmitted from the network router **410** to the connection module **413** in a network transmission manner. On the other hand, after the search message is received by the first passive electronic device **411**, the first internal network communication address data I**1** and the first connecting port data P**1** are transmitted from the first passive electronic device **411** to the connection module **413** through internal connection. Similarly, after the search message is received by the second passive electronic device **412**, the second internal network communication address data I**2** and the second connecting port data P**2** are transmitted from the second passive electronic device **412** to the connection module **413** through network transmission (i.e. the step (A2) is performed by the network area **41**). Then, the internet communication address data I, the first internal network communication address data I**1**, the first connecting port data P**1**, the second internal network communication address data I**2** and the second connecting port data P**2** are received by and stored into the connection module **413** (i.e. the step (A3) is performed by the connection module **413**). Under this circumstance, the internet communication address data I, the first internal network communication address data I**1**, the first connecting port data P**1**, the second internal network communication address data I**2** and the second connecting port data P**2** are acquired by the connection module **413**.

By the way, the device of the UPnP group that complies with the UPnP protocol should respond to the search message after the search message is received. Similarly, the passive electronic device that complies with the DLNA protocol should respond to the search message after the search message is received. In accordance with the present invention, the area network system **4** complies with the UPnP protocol and the DLNA protocol. Consequently, in the area network group **41**, the data for connection is transmitted from the network router **410**, the first passive electronic device **411** and the second passive electronic device **412** to the connection module **413**, but is not limited thereto.

Alternatively, in another embodiment, the step (A) comprises other sub-steps in replace of the sub-steps (A1)~(A3). FIG. **7** is a flowchart illustrating the step (A) of the network connection method according to another embodiment of the present invention. The step (A) comprises the following sub-steps.

In the sub-step (A4), the network router issues the internet communication address data after a first preset time period, and the plural passive electronic devices issues the corresponding internal network communication address data and the corresponding connecting port data after a second time period. In the sub-step (A3), the internet communication address data from the network router and the plural internal network communication address data and the plural connecting port data from the plural passive electronic devices are received by the connection module.

That is, the sub-step (A4) performed by the area network system **4** may be used to replace the sub-steps (A1)~(A2). According to the UPnP protocol, after the search message has not been received for a certain time period, the device of the UPnP group should output data to indicate that this device is still present in the UPnP group. On the other hand, if the data outputted from this device has not been received by another device for a certain time period, another device may realize that this device has been turned off or removed and is not present in the UPnP group. The above conditions are also applied to the device that complies with the DLNA protocol. By performing the sub-step (A4), the internal connection in the area network group can be established without the need of issuing the search message.

Hereinafter, the detailed procedure of the step (B) will be illustrated with reference to FIGS. **8** and **9**. FIG. **8** is a flowchart illustrating the step (B) of the network connection method according to an embodiment of the present invention. FIG. **9** schematically illustrates a communication address look-up table of the area network system according to an embodiment of the present invention. The step (B) comprises the following sub-steps. In the sub-step (B1), the connection module assigns the internet communication address data and the first connecting port data to the first passive electronic device, and assigns the internet communication address data and the second connecting port data to the second passive electronic device. In the sub-step (B2), the connection module stores the internet communication address data and the first connecting port data into a first external communication address field of the communication address look-up table, and stores the internet communication address data and the second connecting port data into a second external communication address field of the communication address look-up table. In the sub-step (B3), the connection module stores the first internal network communication address data and the first connecting port data into a first internal communication address field of the communication address look-up table, and stores the second internal network communication address data and the second connecting port data into a second internal communication address field of the communication address look-up table. In the sub-step (B4), the communication address look-up table is transmitted from the connection module to the network router.

The contents of the communication address look-up table T are shown in FIG. **9**. The communication address look-up table T is established by the connection module **413** after the sub-steps (B1)~(B3) of the step (B) are performed. In the sub-step (B1), the connection module **413** assigns the internet communication address data I (i.e. 168.10.20.30) and the first connecting port data P**1** (i.e. 1000) to the first passive electronic device **411**, and assigns the internet communication address data I and the second connecting port data P**2** (i.e. 500) to the second passive electronic device **412**. For the user outside the area network group **41**, the internet communication address data I and the first connecting port data P**1** about the first passive electronic device **411** are "168.10.20.30, 1000", and the internet communication address data I and the second connecting port data P**2** about the second passive electronic device **412** are "168.10.20.30, 500".

In the sub-step (B2), the connection module **413** stores the internet communication address data I and the first connecting port data P**1** into a first external communication address field C**11** of the communication address look-up table T, and stores the internet communication address data I and the second connecting port data P**2** into a second external communication address field C**12** of the communication address look-up table T.

In the sub-step (B3), the connection module **413** stores the first internal network communication address data I**1** (i.e. 10.1.1.1) and the first connecting port data P**1** into a first internal communication address field C**21** of the communication address look-up table T, and stores the second internal network communication address data I**2** (i.e. 10.1.1.2) and the second connecting port data P**2** into a second internal communication address field C**22** of the communication address look-up table T. Both of the first external communication address field C**11** and the first internal communication address field C**21** contain the first connecting port data P**1**. Consequently, the first external communication address field C**11** corresponds to the first internal communication address field C**21**. Similarly, the second external communication address field C**12** corresponds to the second internal communication address field C**22**.

After the above procedures are completed, the communication address look-up table T is created. If the area network group **41** contains any additional passive electronic device, the above procedures for the additional passive electronic device will performed, and these procedures are not redundantly described herein. After the communication address look-up table T is created, the communication address look-up table T is transmitted from the connection module **413** to the network router **410** (i.e. the sub-step (B4) is performed by the connection module **413**). After the step (B) is completed, the controlling device **40** can be connected to the area network group **41** through network connection.

Hereinafter, the detailed procedure of the step (C) performed by the area network system **4** will be illustrated with reference to FIGS. **4** and **10**. FIG. **10** is a flowchart illustrating the step (C) of the network connection method according to an embodiment of the present invention. The step (C) comprises the following sub-steps.

In the sub-step (C1), the controlling device issues the control command, the internet communication address data and the first connecting port data to the network router. In the sub-step (C2), the network router searches the first external communication address field from the communication

address look-up table according to the internet communication address data and the first connecting port data. In the sub-step (C3), the network router searches the first internal communication address field corresponding to the first external communication address field from the communication address look-up table according to the first external communication address field. In the sub-step (C4), the network router issues the control command to the first passive electronic device according to the first internal network communication address data and the first connecting port data in the first internal communication address field.

When the user outside the area network group **41** intends to acquire a first media file M**1** from the first passive electronic device **411**, the user may operate the controlling device **40** to issue a first control command O**1** to the first passive electronic device **411**. That is, when the sub-step (C1) is performed by the controlling device **40**, the controlling device **40** is connected to the network router **410** through network connection according to the internet communication address data I and the first connecting port data P**1** (e.g. "168.10.20.30, 1000"). Then, the sub-step (C2) is performed by the network router **410**. That is, the network router **410** searches the field containing the internet communication address data I and the first connecting port data P**1** from the communication address look-up table T. The searching result is the first external communication address field C**11**. Then, the sub-step (C3) is performed by the network router **410**. That is, after the first external communication address field C**11** is searched by the network router **410**, the network router **410** searches the first internal communication address field C**21** corresponding to the first external communication address field C**11** from the communication address look-up table T. Afterwards, the sub-step (C4) is performed by the network router **410**. That is, the network router **410** issues the first control command O**1** to the first passive electronic device **411** according to the first internal network communication address data I**1** and the first connecting port data P**1** (e.g. "10.1.1.1, 1000") of the first internal communication address field C**21**. After the step (C) is completed, the first passive electronic device **411** executes a corresponding controlled task according to the first control command O**1**. For example, if the first control command O**1** is a transmission command, the first media file M**1** is transmitted from the first passive electronic device **411** to the controlling device **40** or the second passive electronic device **412** according to the transmission command.

A process of controlling the second passive electronic device **412** by the controlling device **40** will be illustrated as follows. Please also refer to FIG. **4**. When the user intends to play a second media file M**2** of the second passive electronic device **412**, the user may operate the controlling device **40** to issue a second control command O**2** to the second passive electronic device **412**. The controlling device **40** is connected to the network router **410** through network connection according to the internet communication address data I and the second connecting port data P**2** (e.g. "168.10.20.30, 500"). Then, the network router **410** searches the field containing the internet communication address data I and the second connecting port data P**2** from the communication address look-up table T. The search resulting is the second external communication address field C**12**. After the second external communication address field C**12** is searched by the network router **410**, the network router **410** searches the second internal communication address field C**22** corresponding to the second external communication address field C**12** from the communication address look-up table T. Then, the network router **410** issues the second control command O**2** to the second passive electronic device **412** according to the second internal network communication address data I**2** and the second connecting port data P**2** (e.g. "10.1.1.2, 500") of the second internal communication address field C**22**. Afterwards, the second passive electronic device **412** executes a corresponding controlled task according to the second control command O**2**. For example, if the second control command O**2** is a play command, the second media file M**2** is played by the second passive electronic device **412** according to the play command.

Moreover, the area network system **4** may provide an automatic updating function. The automatic updating function complies with the DLNA protocol. For example, when a third passive electronic device (not shown) is newly added to the area network group **41**, a third internal network communication address data and a third connecting port data corresponding to the third passive electronic device are automatically transmitted from the third passive electronic device to the connection module **413** according to the DLNA protocol. After the step (B) is performed by the connection module **413**, a third external communication address field and a third internal communication address field corresponding to the third passive electronic device are added to the communication address look-up table T. In other words, when the third passive electronic device is newly added to the area network group **41**, the third external communication address field and the third internal communication address field corresponding to the third passive electronic device are simultaneously added to the communication address look-up table T. On the other hand, if the second passive electronic device **412** is turned off, a device removable message is automatically generated. According to the device removable message, the second external communication address field C**12** and the second internal communication address field C**22** are corresponding to the second passive electronic device **412** are simultaneously removed from the communication address look-up table T by the connection module **413**.

From the above descriptions, the present invention provides an area network system and a network connection method. Firstly, the internet communication address data, the plural internal network communication address data and the plural connecting port data are automatically transmitted to the connection module according to the UPnP protocol and the DLNA protocol. In addition, the communication address look-up table is created by the built-in connection module of the passive electronic device according to the above data. Consequently, it is not necessary to manually input the internet communication address data, the plural internal network communication address data and the plural connecting port data into the network router. Moreover, the communication address look-up table may be automatically updated when a passive electronic device is newly added or turned off. Consequently, whenever a passive electronic device is newly added or turned off by the user, it is not necessary to manually input the updated communication address data and the updated connecting port data into the passive electronic device. In other words, the area network system and the network connection method of the present invention are user-friendly while reducing the burden on the user.

While the invention has been described in terms of what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention needs not be limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.

What is claimed is:

1. A network connection method for connecting a controlling device to at least one passive electronic device of an area network group, one of the at least one passive electronic device executing a connection module of the area network group, the network connection method comprising steps of:

(A) the connection module of the area network group receiving an internet communication address data from a network router of the area network group and at least one internal network communication address data and at least one connecting port data from the at least one passive electronic device;

(B) the connection module creating a communication address look-up table according to the internet communication address data, the at least one internal network communication address data and the at least one connecting port data, and transmitting the communication address look-up table to the network router; and

(C) transmitting a control command from the controlling device to the area network group according to the internet communication address data and the at least one connecting port data, and transmitting the control command from the network router to the at least one passive electronic device according to the internet communication address data, the at least one connecting port data and the communication address look-up table.

2. The network connection method according to claim 1, wherein the step (A) comprises sub-steps of:

(A1) issuing a search message from the connection module;

(A2) issuing the internet communication address data from the network router according to the search message, and outputting the at least one internal network communication address data and the at least one connecting port data from the at least one passive electronic device according to the search message; and

(A3) the connection module receiving the internet communication address data from the network router and the at least one internal network communication address data and the at least one connecting port data from the at least one passive electronic device.

3. The network connection method according to claim 1, wherein the step (A) comprises sub-steps of:

(A4) issuing the internet communication address data from the network router after a first preset time period, and issuing the at least internal network communication address data and the at least one connecting port data from the at least one passive electronic device after a second time period; and

(A3) the connection module receiving the internet communication address data from the network router and the at least one internal network communication address data and the at least one connecting port data from the at least one passive electronic device.

4. The network connection method according to claim 1, wherein before the step (A), the network connection method further comprises steps of:

(D1) the network router assigning the at least one internal network communication address data to the at least one passive electronic device, wherein the at least one connecting port data is previously stored in the at least one passive electronic device; and

(D2) storing the internal network communication address data into the at least one passive electronic device.

5. The network connection method according to claim 1, wherein the step (B) comprises sub-steps of:

(B1) the connection module assigning the internet communication address data and a first connecting port data of the at least one connecting port data to a first passive electronic device of the at least one passive electronic device, and assigning the internet communication address data and a second connecting port data of the at least one connecting port data to a second passive electronic device of the at least one passive electronic device;

(B2) the connection module storing the internet communication address data and the first connecting port data into a first external communication address field of the communication address look-up table, and storing the internet communication address data and the second connecting port data into a second external communication address field of the communication address look-up table;

(B3) the connection module storing a first internal network communication address data of the at least one internal network communication address data and the first connecting port data into a first internal communication address field of the communication address look-up table, and storing a second internal network communication address data of the at least one internal network communication address data and the second connecting port data into a second internal communication address field of the communication address look-up table, wherein the first external communication address field corresponds to the first internal communication address field, and the second external communication address field corresponds to the second internal communication address field; and

(B4) transmitting the communication address look-up table from the connection module to the network router.

6. The network connection method according to claim 1, wherein the step (C) comprises sub-steps of:

(C1) the network router receiving the control command, the internet communication address data and a first connecting port data of the at least one connecting port data from the controlling device;

(C2) the network router searching a first external communication address field from the communication address look-up table according to the internet communication address data and the first connecting port data;

(C3) the network router searching a first internal communication address field corresponding to the first external communication address field from the communication address look-up table according to the first external communication address field; and

(C4) the network router issuing the control command to a first passive electronic device of the at least one passive electronic device according to a first internal network communication address data of the at least one internal network communication address data and the first connecting port data in the first internal communication address field, wherein the network router complies with a universal plug and play (UPnP) protocol, and the at least one passive electronic device complies with a Digital Living Network Alliance (DLNA) protocol.

7. An area network system, comprising:

a controlling device issuing a control command according to an internet communication address data and at least one connecting port data; and

an area network group connected to the controlling device through network connection, wherein the area network group comprises:

a network router connected to the controlling device through network connection to provide a network connection function and receive the control command, wherein the internet communication address data is previously stored in the network router;

at least one passive electronic device connected to the network router through network connection, wherein an internal network communication address data and a corresponding connecting port data of the at least one connecting port data are previously stored in each of the at least one passive electronic device; and

a connection module executed by one of the at least one passive electronic device, the connection module being connected to the network router through network connection for creating a communication address look-up table according to the internet communication address data, the at least one internal network communication address data and the at least one connecting port data, and transmitting the communication address look-up table to the network router, wherein when the control command is received by the network router, the control command is transmitted from the network router to the at least one passive electronic device according to the internet communication address data, the at least one connecting port data and the communication address look-up table.

8. The area network system according to claim **7**, wherein after the internet communication address data, a first internal network communication address data of the at least one internal network communication address data and a first connecting port data of the at least one connecting port data are received by the connection module, the connection module assigns the internet communication address data and the first connecting port data to a first external communication address field of the communication address look-up table and assigns the first internal network communication address data and the first connecting port data to a first internal communication address field of the communication address look-up table, wherein the first external communication address field corresponds to the first internal communication address field, and the first internal network communication address data and the first connecting port data correspond to a first passive electronic device of the at least one passive electronic device.

9. The area network system according to claim **8**, wherein after the control command is received by the network router, the network router searches the first external communication address field from the communication address look-up table according to the internet communication address data and the first connecting port data and searches the first internal communication address field corresponding to the first external communication address field from the communication address look-up table, wherein the network router issues the control command to the first passive electronic device according to the first internal network communication address data and the first connecting port data in the first internal communication address field.

10. The area network system according to claim **7**, wherein after the internet communication address data, a second internal network communication address data of the at least one internal network communication address data and a second connecting port data of the at least one connecting port data are received by the connection module, the connection module assigns the internet communication address data and the second connecting port data to a second external communication address field of the communication address look-up table and assigns the second internal network communication address data and the second connecting port data to a second internal communication address field of the communication address look-up table, wherein the second external communication address field corresponds to the second internal communication address field, and the second internal network communication address data and the second connecting port data correspond to a second passive electronic device of the at least one passive electronic device.

11. The area network system according to claim **10**, wherein after the control command is received by the network router, the network router searches the second external communication address field from the communication address look-up table according to the internet communication address data and the second connecting port data and searches the second internal communication address field corresponding to the second external communication address field from the communication address look-up table, wherein the network router issues the control command to the second passive electronic device according to the second internal network communication address data and the second connecting port data in the second internal communication address field.

12. The area network system according to claim **7**, wherein the connection module is a software component included in a first passive electronic device of the at least one passive electronic device or a second passive electronic device of the at least one passive electronic device.

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